(19) Europäisches Patentamt
European Patent Office
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(11) **EP 2 886 736 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
24.06.2015 Bulletin 2015/26

(51) Int Cl.:
E04D 13/03 *(2006.01)*

(21) Application number: **14198965.7**

(22) Date of filing: **18.12.2014**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

(30) Priority: **20.12.2013 BE 201300865**

(71) Applicant: **Glorieux, Jean Marc Gilles**
8554 Zwevegem (Sint-Denijs) (BE)

(72) Inventor: **Glorieux, Eric Marcel Hubert**
deceased (BE)

(74) Representative: **D'Halleweyn, Nele Veerle Trees Gertrudis et al**
Arnold & Siedsma
Bezuidenhoutseweg 57
2594 AC The Hague (NL)

(54) **Modular roof element particularly intended for a barrel vault skylight**

(57) Modular roof element comprising a first plate for forming a support structure; a second plate of a plastic material arranged above the first plate; a first and a second longitudinal profile, wherein a first longitudinal side and second longitudinal side of the first and second plate are supported in respectively the first and second longitudinal profile; at least one transverse profile which connects the first longitudinal profile to the second longitudinal profile, which at least one transverse profile extends above the first plate.

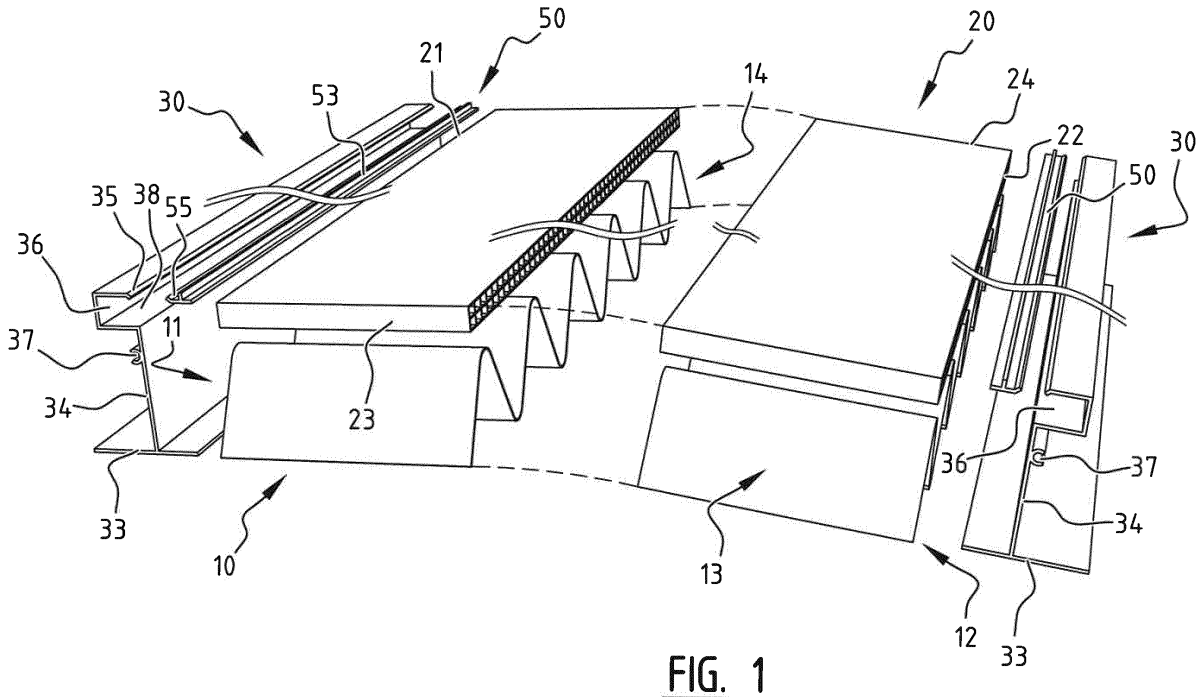

FIG. 1

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Description

[0001] The present invention relates to a modular roof element comprising at least a first plate for forming a support structure, and to a barrel vault skylight comprising a plurality of such modular roof elements.

[0002] According to the prior art, barrel vault skylights are constructed on site using one or more plates mounted on a series of longitudinal and/or transverse profiles. A barrel vault skylight which is common in Belgium is constructed from one or more profiled arcuate plates which are for instance manufactured from a polyester resin reinforced with glass fibre. These arcuate plates are typically produced on the basis of the span of the upstand on which the barrel vault skylight has to be provided. The U-value is however relatively high in such barrel vault skylights. Other known barrel vault skylights are constructed from a combination of curved aluminium profiles for supporting flexible, multi-walled polycarbonate plates. Other known barrel vault skylights also make use of a combination of a plurality of plates one above another in order to improve both the U-value and the load-bearing capacity. In the case of such barrel vault skylights where a plurality of plates have to be mounted one above another, mounting of the plates on an upstand is usually quite complex and the mounting requires a large number of operations.

[0003] The present invention has for its object to provide a modular roof element in which a plurality of plates are received one above another, which roof element simplifies the mounting on an upstand.

[0004] A modular roof element according to the invention comprises for this purpose a first plate for forming a support structure, a second plate of a plastic material, a first and a second longitudinal profile and at least one transverse profile. The second plate is arranged above the first plate. A first longitudinal side and second longitudinal side of the first and second plate are supported in respectively the first and second longitudinal profile. The at least one transverse profile connects the first longitudinal profile to the second longitudinal profile and extends above the first plate.

[0005] The first longitudinal profile is fixed relative to the second longitudinal profile by providing at least one transverse profile which connects the first longitudinal profile to the second longitudinal profile. This structure of longitudinal profiles and transverse profiles will further ensure that the first and second plates are fixed in the first and second longitudinal profiles, while taking into account the fact that the first plate forms a support structure and is therefore a relatively stiff plate. Such a modular roof element can be mounted easily on an upstand, wherein only the first and the second longitudinal profile have to be fixed to the upstand.

[0006] In an advantageous embodiment the first plate is a profiled plate. The strength of the first plate can in this way be increased without the plate having to take a very thick form. The second plate is preferably a multi-walled plate which is manufactured for instance by extrusion. Such plates have the advantage of having a low U-value. The second plate can however also be a flat solid plate.

[0007] In an advantageous embodiment the at least one transverse profile extends above and/or below the second plate. The at least one transverse profile can in this way support and/or fixedly clamp the second plate. The or each transverse profile is preferably clamped fixedly at a first outer end in or against the first longitudinal profile and at a second outer end in or against the second longitudinal profile. A transverse profile can for this purpose be provided at the first and second outer end with a threaded hole which co-acts with a bolt protruding through a hole in the first and second longitudinal profile. The first outer end can further be received in a longitudinal channel of the first longitudinal profile, and the second outer end can be received in a longitudinal channel of the second longitudinal profile. An outer end of a transverse profile which extends above the second plate can then be received for instance in the same longitudinal channel of the longitudinal profile as a longitudinal side of the second plate itself.

[0008] In the preferred embodiment the at least one transverse profile comprises a first transverse profile close to a first transverse side of the second plate, and a second transverse profile close to a second transverse side of the second plate. Such an embodiment has the advantage that the transverse profiles can likewise be used to couple two adjacent modular roof elements. The first transverse profile can thus be provided with a first coupling profile which can be coupled to a second transverse profile of an adjacent roof element. The coupling profile can for instance be a U-profile. Such a coupling profile can then be fixed, with the open side of the U directed downward, to the first transverse profile and be fixed, with the open side of the U directed upward, to the second transverse profile such that a coupling of adjacent roof elements is possible in simple manner.

[0009] In a further embodiment one or more intermediate transverse profiles can also be provided in addition to the first and the second transverse profiles. It is further also possible to provide the transverse profiles not along the transverse side but rather at a distance therefrom.

[0010] In an advantageous embodiment the or each transverse profile comprises an upper part and a lower part between which the second plate is fixedly clamped. The coupling profile can then be formed with a fixing part which is fixedly clamped between the upper and the lower of the or each transverse profile, in the case that transverse profiles are provided close to the first and second transverse sides.

[0011] In a possible embodiment a first clamping profile which is received clampingly in the first longitudinal profile is arranged between the first outer end of the first transverse profile and the first outer end of the second transverse profile, and a second clamping profile which is received clampingly in the second longitudinal profile

is arranged between the second outer end of the first transverse profile and the second outer end of the second transverse profile. Such an embodiment is particularly advantageous when the longitudinal sides of the second plate and the outer ends of the first and second transverse profiles are received in the same longitudinal channel of the longitudinal profiles. Such clamping profiles then allow compensation of the clearance occurring as a result of receiving the outer ends of the transverse profiles. It is noted here that when the transverse profiles are in two parts, with an upper part above the second plate and a lower part below the second plate, only the outer ends of the upper parts are typically received in a longitudinal channel of the longitudinal profile.

[0012] In a preferred embodiment the first plate has a longitudinal direction parallel to the first and second longitudinal side thereof, and a transverse direction parallel to a transverse side thereof, and the first plate is formed as an arch as seen in transverse direction. The first plate is preferably provided with a profiling in the longitudinal direction. The second plate is further preferably flexible such that it can substantially take on the arcuate form of the first plate by being fixed between the first and the second longitudinal profile. The or each transverse profile is then preferably formed as an arch. The radius of curvature of the arch preferably lies between 0.5 and 50 m. In an embodiment in which use is made of a first and a second transverse profile close to respectively the first and second transverse sides of the second plate, a coupling profile can be provided which is more flexible than the material of the first and second transverse profiles such that the coupling profile can substantially take on the arcuate form of the first and second transverse profiles. The or each transverse profile can be manufactured from metal, but can also be manufactured from a strong plastic material, for instance a fibre-reinforced plastic material or a polycarbonate. The advantage of using a plastic material is that the U-value is better and that no special measures need be made in order to avoid cold bridges at the position of the connection between the transverse profile and the longitudinal profile, and that problems with different coefficients of expansion can be avoided in simple manner.

[0013] The first plate is preferably manufactured from a composite material. The composite material is preferably a resin from the group of: polyester resins or other thermoset resins. Fibres such as glass fibres can optionally be added in order to further strengthen the material. The plastic material of the second plate is preferably a material from the group of: polycarbonate, acrylate, PET or other thermoplastics. These materials have the advantage that light-transmitting, flexible and light multi-walled plates can be manufactured, for instance by extrusion. The upper side of the second plate can take a UV-resistant form here. According to a variant, the second plate is a solid plate of a fibre-reinforced polyester material or of a composite material.

[0014] In a possible embodiment the second plates can be provided on their transverse sides with a connecting profile, whereby the transverse sides of two adjacent roof elements are connectable to each other. This can for instance be a protruding transverse part on a first transverse side and a recess on the second transverse side which can be mutually engaging.

[0015] In an advantageous embodiment each longitudinal profile comprises a base, an upright wall connected to the base and a longitudinal channel connected to the upright wall. The base is configured to support the first/second longitudinal side of the first plate, wherein this longitudinal side of the first plate further rests against the upright wall. A first/second longitudinal side of the second plate is received in the longitudinal channel. The upper part of a transverse profile can optionally also be received in this longitudinal channel. A clamping profile can further likewise be received in this longitudinal channel, above the second plate, between two transverse profiles.

[0016] The invention will be further elucidated on the basis of a number of non-limitative exemplary embodiments of a modular roof element according to the invention, with reference to the accompanying figures, in which:

Figure 1 is a cut-away perspective view of a modular roof element according to a first embodiment, in which the transverse profiles are omitted;

Figure 2 is a cut-away perspective view of the embodiment of figure 1 with a first transverse profile, wherein the first plate and the second transverse profile are omitted;

Figure 3 is a schematic cross-section through the modular roof element of figures 1 and 2 at the position of the connection between a first modular roof element and a second, adjacent modular roof element;

Figure 4 is a cross-section of a second embodiment of a modular roof element according to the invention;

Figures 5 and 6 illustrate schematically two variants of the second plate;

Figure 7 illustrates schematically a variant of the first plate; and

Figure 8 illustrates a perspective view of a barrel vault skylight assembled with modular roof elements.

[0017] Figures 1, 2 and 3 illustrate schematically a first embodiment of a modular roof element according to the invention. The modular roof element comprises a first profiled plate 10, a second multi-walled plate 20, a first and second longitudinal profile 30 and a first and second transverse profile 40. The first plate is a profiled, relatively stiff plate which forms a support structure. The first plate is preferably manufactured from a composite material. First plate 10 has a first longitudinal side 11, a second longitudinal side 12, a first transverse side 13 and a second transverse side 14, see figure 1. Second plate 20 is

a multi-walled plastic plate which is preferably manufactured by extrusion. Second plate 20 is a relatively flexible plate compared to first plate 10. Second plate 20 has a first longitudinal side 21, a second longitudinal side 22, a first transverse side 23 and a second transverse side 24. The first longitudinal sides 11, 21 of respectively the first and second plate are received in the first longitudinal profile 30 and the second longitudinal sides 12, 22 of respectively the first and second plate are received in the second longitudinal profile 30. A first and second two-part transverse profile 40 connects the first longitudinal profile 30 to the second longitudinal profile 30. Each two-part transverse profile 40 extends above the first plate, wherein a first part 41 lies above the second plate and a second part 42 lies below the second plate, see figures 2 and 3.

[0018] The first and second longitudinal profiles 30 each comprise a base 33, an upright wall 34 and a longitudinal channel 36. Base 33 is configured to support a longitudinal side 11, 12 of the first plate thereon, wherein the longitudinal side further rests against upright wall 34. Base 33 can further be provided with holes (not shown) for attaching the base 33 to an upstand. Upright wall 34 forms the connection between base 33 and a longitudinal channel 36 in which a longitudinal side 21, 22 of second plate 20 is received. Longitudinal channel 36 is provided for this purpose with a longitudinal opening 38 which faces toward a longitudinal side 21, 22 and along which longitudinal side 21, 22 can be inserted into longitudinal channel 36.

[0019] Figure 2 shows only one transverse profile 40, although in the illustrated embodiment a first such transverse profile 40 is arranged close to the first transverse side 23 and a second such transverse profile 40 is arranged close to the second transverse side 24. Each transverse profile 40 comprises an upper part 41 and a lower part 42. A first end 44 of upper part 41 is arranged in a longitudinal channel 36 of first longitudinal profile 30 above second plate 20, and a second outer end 45 of upper part 41 is arranged in a longitudinal channel 36 of the second longitudinal profile 30. First end 44 and second end 45 can be provided with a threaded hole 48 which is intended to co-act with a screw 68 through a hole in longitudinal channel 36. Lower part 42 of transverse profile 40 has a first end 46 which is fixed against a wall part 34 of a first longitudinal profile 30, and a second outer end 42 which is fixed against a wall part 34 of a second longitudinal profile 30. Second plate 20 is clamped fixedly between upper part 41 and lower part 42 of transverse profile 40. A coupling profile 70 is further received between upper part 41 and lower part 42. As shown best in figures 2 and 3, coupling profile 70 comprises a U-shaped part 71 and a fixing part 72. Fixing part 72 is fixed between upper part 41 and lower part 42. As shown best in figure 3, the U-shaped part is mounted with the open side downward at a first transverse edge, while the U-shaped part is mounted with the open side upward at a second transverse edge. Two adjacent roof elements can in this way be coupled to each other in simple manner. First plate 10 is dimensioned in the longitudinal direction such that there is some overlap when two adjacent roof elements are coupled, see figure 3. A continuous support structure is in this way obtained after coupling of a number of adjacent roof elements to each other.

[0020] As best shown in figure 1, first plate 10 is formed as an arch as seen in the transverse direction, and first plate 10 is provided in the longitudinal direction with a profiling consisting of a succession of peaks and valleys. Second plate 20 is not pre-shaped but is flexible such that, through clamping of second plate 20 between the first and second longitudinal profiles 30, it substantially takes on the arcuate form of first plate 10. It is noted that in a normal position of use second plate 20 typically does not make contact with first plate 10. When the roof element is subjected to a load such as a snow load, second plate 20 will however typically make contact with first plate 10. As best shown in figure 2, each transverse profile 40 is likewise formed as an arch. Transverse profile 40 is preferably formed from a stiff material such as a metal or a stiff plastic. In a possible embodiment coupling profile 70 is manufactured from a flexible plastic and coupling profile 70 is not pre-shaped. Coupling profile 70 is then flexible such that it substantially takes on the arcuate form of the transverse profile after clamping thereof between upper part 41 and lower part 42 of transverse profile 40.

[0021] Figure 4 illustrates a second embodiment of a roof element according to the invention. The roof element comprises a first profiled plate 410, a second, multi-walled plate 420, two longitudinal profiles (not shown) and one two-part transverse profile 440. Transverse profile 440 comprises a first part 441 and a second part 442, between which the second plate 420 is received. The outer ends of the two parts 441, 442 are mounted on the respective longitudinal profiles (not shown). Transverse profile 440 can for instance be provided substantially in the centre of the roof element. The coupling between two adjacent roof elements does not take place here via coupling profiles mounted on transverse profiles 440 but by giving a first and a second transverse side of second plate 420 a modified form. In the variant of figure 4 the first transverse side 423 of a second plate 420 is provided with two flexible upward directed transverse ribs 428. The second transverse side 424 of a second plate 420 of an adjacent roof element is provided with a substantially channel-like part 427. This channel-like part 427 and the transverse ribs 428 co-acting therewith are formed such that the ribs can be clipped into the channel-like part. This channel-like part 427 and ribs 428 can be manufactured integrally with second plate 420.

[0022] Figures 5 and 6 illustrate two further variants for the second plate. In the variant of figure 5 second plate 520 is provided on a first transverse side 523 with a protruding transverse part 528 and provided on a second transverse side 524 with a transverse recess 527.

During placing of adjacent roof elements the protruding transverse part 528 can be pressed in simple manner into transverse recess 527. In the variant of figure 6 second plate 620 is provided on a first transverse side 623 with a downward directed flange 628 and provided on a second transverse side 624 with a transverse channel 627 with an upward facing open side. During coupling of adjacent roof elements the downward directed flange 628 can be placed in simple manner in transverse channel 627.

[0023] Figure 7 shows a variant of the first plate. In this variant the first plate is a smooth plate 710 which is provided on a first transverse side 713 with a downward directed flange 715 and provided on a second transverse side 714 with a transverse channel 716 with an upward facing open side. First plate 710 is preferably a smooth arcuate plate.

[0024] Finally, figure 8 illustrates schematically the arranging of a number of roof elements 800 on two upstands 801. Roof elements 800 are arranged adjacently of each other in the longitudinal direction on upstands 801 for the purpose of forming a barrel vault skylight.

[0025] In the above described embodiments the first and the second plate are preferably manufactured from a light- transmitting material. It is however also possible to envisage manufacturing the plate from a semi-transparent or an opaque material, in accordance with the desired application.

[0026] The invention is not limited to the above illustrated exemplary embodiments, and the skilled person will appreciate that many variants can be envisaged within the scope of the invention, which is defined solely by the following claims.

Claims

1. Modular roof element, comprising:

- a first plate (10) for forming a support structure;
- a second plate (20) of a plastic material arranged above the first plate;
- a first and a second longitudinal profile, wherein a first longitudinal side (11, 21) and second longitudinal side (12, 22) of the first and second plate are supported in respectively the first and second longitudinal profile (30);
- at least one transverse profile which connects the first longitudinal profile to the second longitudinal profile, which at least one transverse profile extends above the first plate;

characterized in that the at least one transverse profile comprises a first transverse profile (40) close to a first transverse side (23) of the second plate; and a second transverse profile (40) close to a second transverse side (24) of the second plate; and that the first transverse profile is provided with a first coupling profile (70) for coupling the first transverse side (23) of the second plate (20) to a second transverse profile of an adjacent modular roof element.

2. Modular roof element as claimed in claim 1, **characterized in that** the first plate (10) is a profiled plate.

3. Modular roof element as claimed in claim 1 or 2, **characterized in that** the second plate (20) is a multi-walled plate.

4. Modular roof element as claimed in any of the foregoing claims, **characterized in that** the second plate is a flat solid plate.

5. Modular roof element as claimed in claim 1 or 2, **characterized in that** the at least one transverse profile extends above and/or below the second plate.

6. Modular roof element as claimed in any of the foregoing claims, **characterized in that** the or each transverse profile is clamped fixedly at a first outer end (44) in or against the first longitudinal profile (21) and at a second outer end (45) in or against the second longitudinal profile (22).

7. Modular roof element as claimed in any of the foregoing claims, **characterized in that** a first clamping profile (50) which is received clampingly in the first longitudinal profile is arranged between the first outer end of the first transverse profile and the first outer end of the second transverse profile; and **that** a second clamping profile (50) which is received clampingly in the second longitudinal profile is arranged between the second outer end of the first transverse profile and the second outer end of the second transverse profile.

8. Modular roof element as claimed in any of the foregoing claims, **characterized in that** the coupling profile (70) comprises a U-profile.

9. Modular roof element as claimed in any of the foregoing claims, **characterized in that** the or each transverse profile comprises an upper part (41) and a lower part (42) between which the second plate is fixedly clamped.

10. Modular roof element as claimed in claim 9, **characterized in that** the U-profile is formed with a fixing part clamped fixedly between the upper and the lower part of the or each transverse profile.

11. Modular roof element as claimed in any of the foregoing claims, which first plate has a longitudinal direction parallel to the first and second longitudinal side, and a transverse direction parallel to a transverse side, **characterized in that** the first plate (10)

is formed as an arch as seen in transverse direction, that the first plate is provided with a profiling in the longitudinal direction and **that** the second plate (20) is flexible such that it substantially takes on the arcuate form of the first plate.

12. Modular roof element as claimed in claim 11, **characterized in that** the or each transverse profile (40) is formed as an arch.

13. Modular roof element as claimed in claim 11 or 12, **characterized in that** the coupling profile is mounted on the first transverse profile and is manufactured from a plastic which is more flexible than the material of the first transverse profile such that the coupling profile substantially takes on the arcuate form of the first transverse profile.

14. Modular roof element as claimed in any of the foregoing claims, **characterized in that** the first plate (10) is manufactured from a composite material, preferably a resin from the group of:

polyester resin, thermoset resins; and that the plastic material of the second plate (20) is a material from the group of: polycarbonate, acrylate, PET and other thermoplastics; or a fibre-reinforced polyester or a composite material.

15. Barrel vault skylight comprising a plurality of modular roof elements as claimed in any of the foregoing claims.

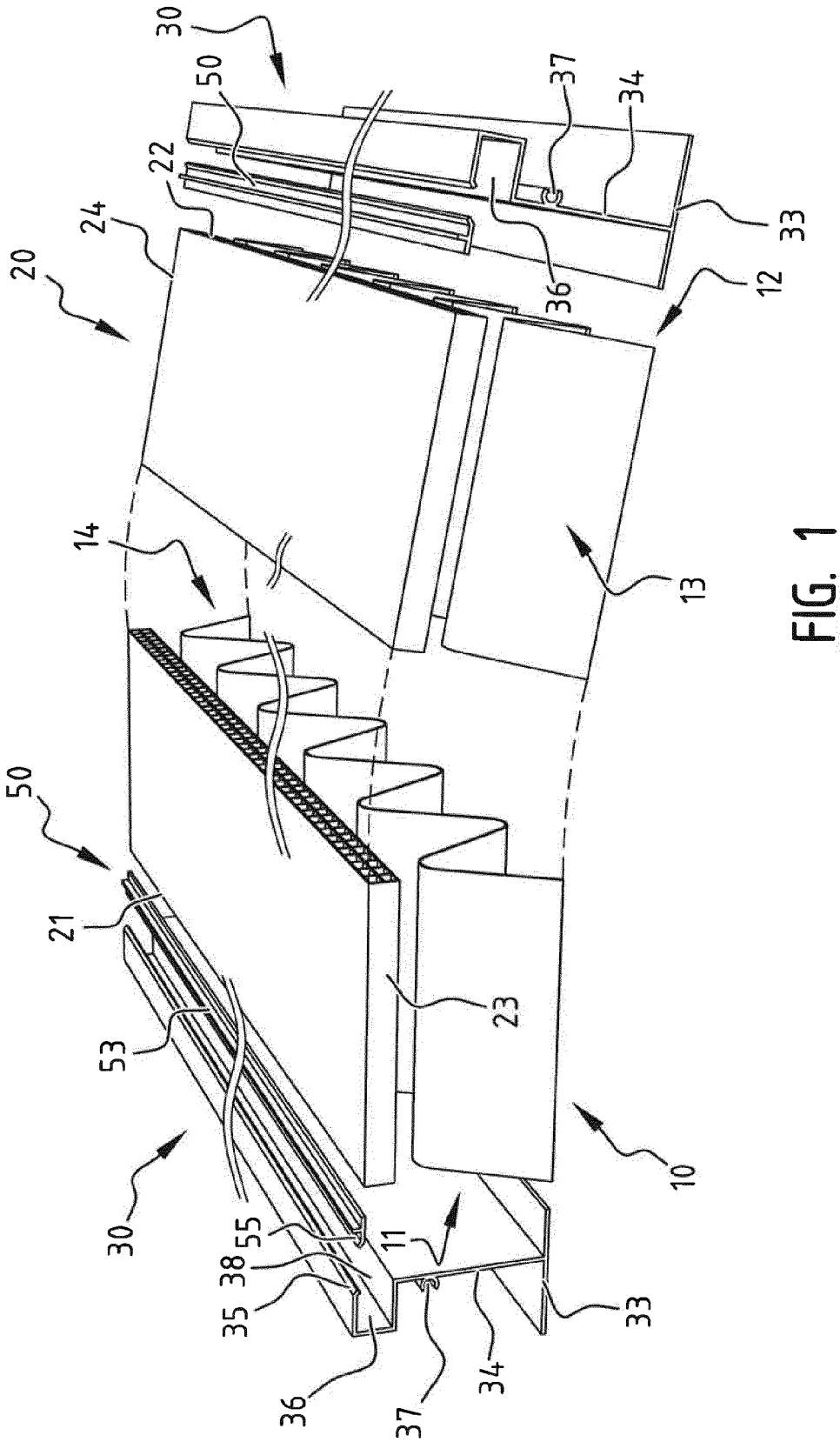
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FIG. 1

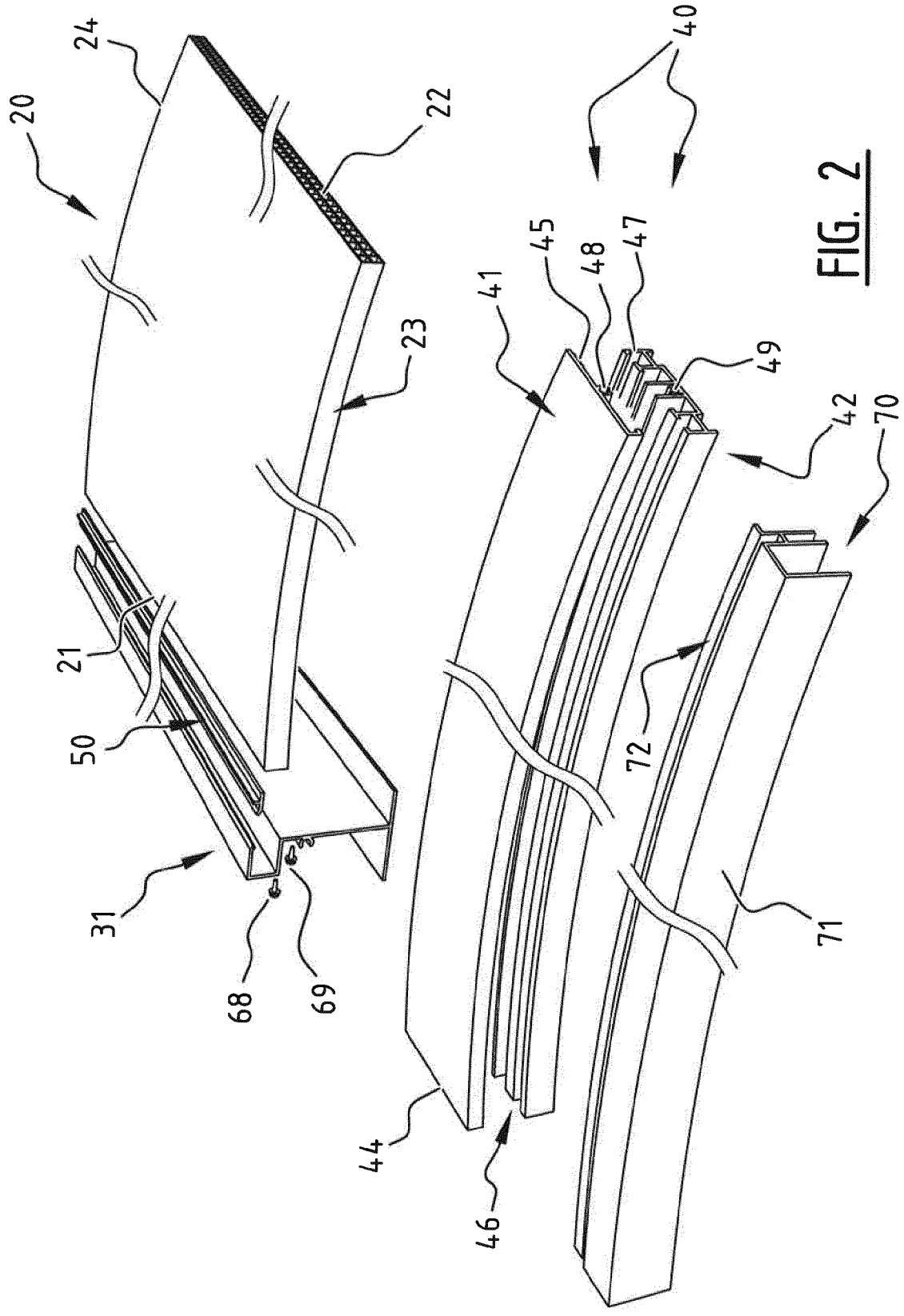

FIG. 2

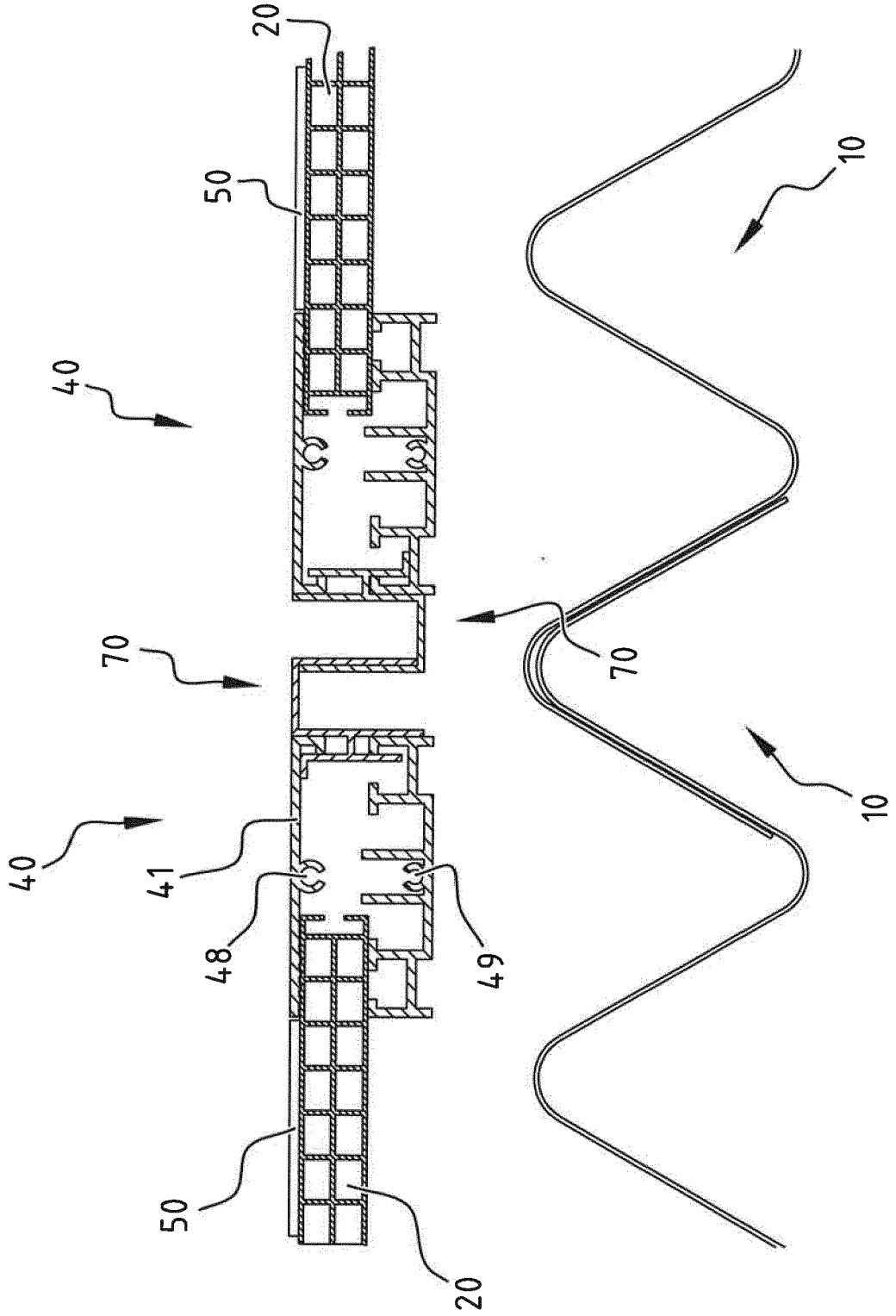

FIG. 3

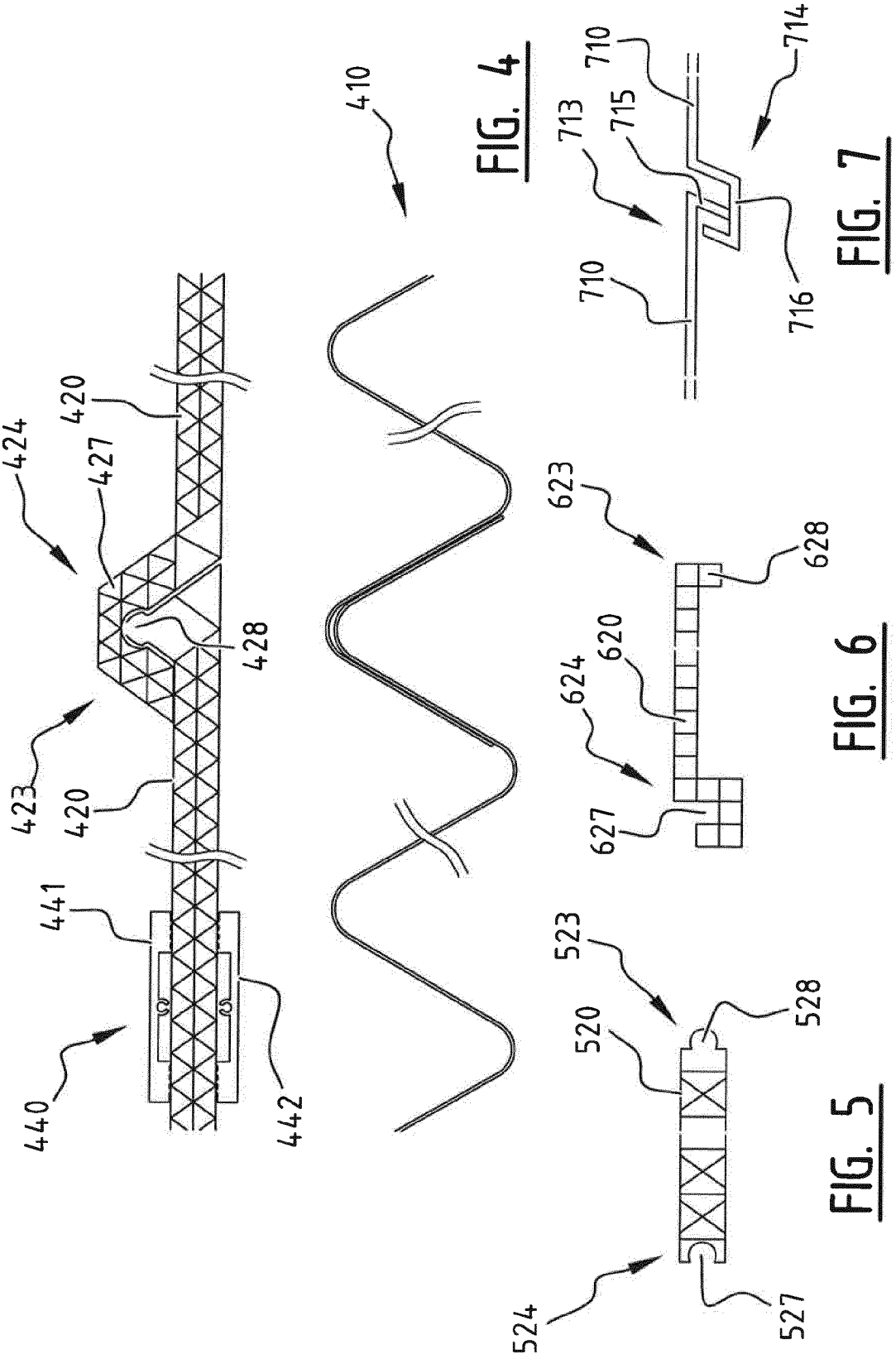

FIG. 4

FIG. 5

FIG. 6

FIG. 7

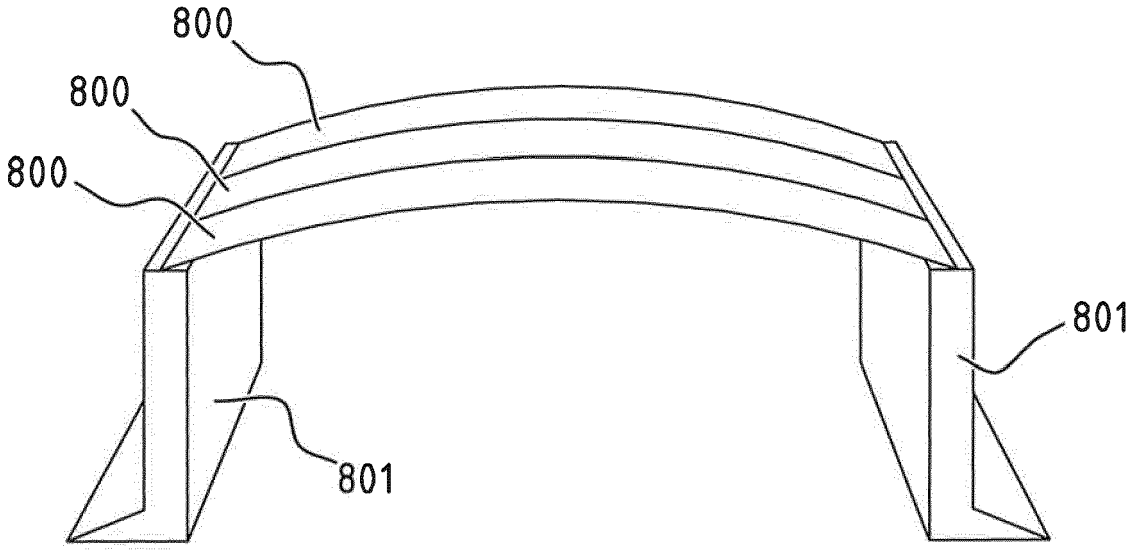

FIG. 8

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EUROPEAN SEARCH REPORT

Application Number
EP 14 19 8965

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	23 April 2015	Demeester, Jan

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